

Supporting Information

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SI Text

Results in Terms of Friction Coefficients. Natural cartilage [before hyaluronic acid (HA) digestion, blue curves] under both low and high loading conditions gives boundary lubrication (BL) behavior with friction coefficients approaching approximately 0.15 in the steady state. However, at low loads (Fig. S2A) the time to reach this steady-state value is much longer than at high loads (Fig. S2B). After HA digestion under low-load conditions, both the friction forces and friction coefficient are low, suggesting that

the system remains in BL but that the HA molecules do not become entangled due to their reduced molecular weight, allowing them to function as effective boundary lubricants (1) [similar to the good boundary lubrication of lipids with short head-groups under low loading conditions (2)]. In contrast, at high loads both the friction force and coefficient are high after HA digestion, consistent with the surfaces becoming pressed into the contact lubrication regime.

1. Benz M, Chen NH, Israelachvili J (2004). Lubrication and wear properties of grafted polyelectrolytes, hyaluronan and hylan, measured in the surface forces apparatus. *J Biomed Mater Res A* 71A:6–15.

2. Jay GD, Haberstroh K, Cha CJ (1997). Comparison of the boundary-lubricating ability of bovine synovial fluid, lubricin, and healon. *J Biomed Mater Res A* 40:414–418.

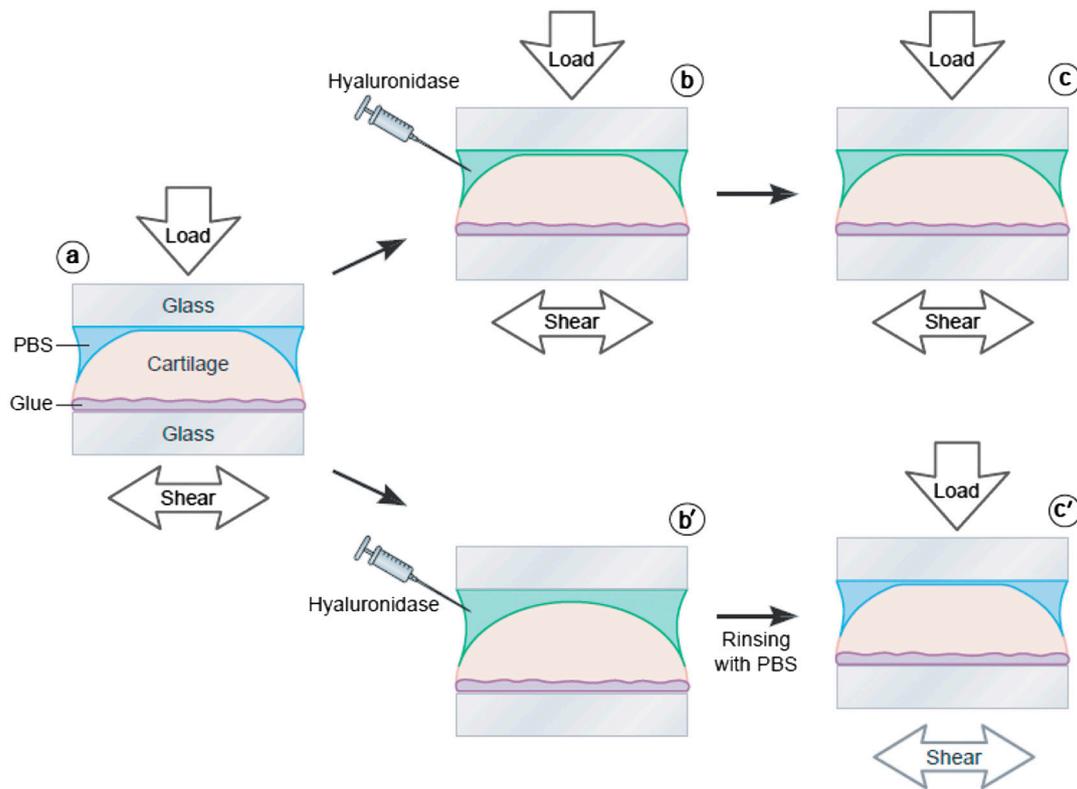


Fig. S1. Schematic representation of the experimental sequences used in this study. Full-thickness sample of porcine femoral cartilage is glued to a glass substrate and brought up against a flat glass disk in PBS solution. (A) Compression of the cartilage during continuous lateral back-and-forth sliding (shear). (B) Hyaluronidase injected during shear. (C) Shear continues under a constant load. (B') Load removed before injection of hyaluronidase followed by a 1-h wait at 25 °C then rinsing with excess PBS. (C') Load reapplied during continuous shear. The sequence A-B-C corresponds to the experiments of Fig. 1, whereas the sequence A-B'-C' corresponds to the experiments of Figs. 2 and 3 and Fig. S2.

